



EFFECT OF POTTING MEDIA ON GROWTH AND YIELD OF CHRYSANTHEMUM

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author AUK designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors MEU, ZNV and ZS managed the analyses of the study. Author ZS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

A field study was conducted to assess the effect of potting media on growth and yield of chrysanthemum at Horticulture Research Centre (HRC), Gazipur, Bangladesh. The experiment was laid out in Randomized Complete Block Design (RCBD) with seven treatments and three replications. It was observed that plant height (54.0 to 66.0 cm); number of leaves per plant (208-240); leaf size (4.5 to 8.5 cm); plant spread (19.0 to 32.0 cm); number of branches (4 to 12); number of flowers (25-40) and stalk length (8.8 to 13.3 cm) varied; respectively in T₇ to T₃. The days of first flowering varied from 55 to 70 days. The maximum days was recorded in treatment T₇ (70 days) whereas the minimum in T₃ (55 days) followed by T₅ (58 days). The treatment T₃ produced the highest weight (5.5 g) of flower stalk per plant and minimum yield (3.0 g) was recorded in T₇ of flower stalk per plant. Maximum duration of flowering was observed in cocodust (T₃) (45 days) and minimum flowering duration in T₇ and T₁ (18 and 20 days). Among the seven potting media, T₃ (cocodust) showed the highest efficacy and it could be used as media in cultivation of *C. indicum* production.

Keywords: *Chrysanthemum indicum*; flower; media.

1. INTRODUCTION

Chrysanthemum (*Chrysanthemum indicum* L.) is a common flower crop belongs to the family Compositae. It is globally the second economically most vital floricultural crop following rose, and one of the most significant ornamental species [1, 2]. It has

been commonly grown in gardens for more than 2500 years [3]. It is one of the most important ornamental crop around the world, and is used as cut, loose flower and pot plant [2]. Many plants, have been identified to use in pharmacology, folk medicine, homoeopathy and ethnopharmacology, have medicinal usage. This crop charity as nerve sedative, anti-oxidant, anti-

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inflammatory, anti-mutagenic, anti-microbial, anti-fungal, anti-angiogenic, anti-atherosclerosis and nematocidal goods. Leaves are remedy and used to cure colds, headache, bronchitis, rheumatism, swellings, boils and expectorant, bitter and stomachic, respectively. *Chrysanthemum indicum* flower has a strong aroma and many of the previous studies focused on the essential oil of this plant [4,5,6].

Growing Media is one of the important characters for cultivation of any kind of plant. media also affects in growth and yield of the plants. For the cultivation of chrysanthemum, good culture media should contain 20-25 gL⁻¹ sucrose and 9 gL⁻¹ of agar, and the pH 5.6-5.7. According to [7] Vendrame et al. 2005, Growing media is known to have effect on the value of potted ornamental plants and plays an important role on germination rate and many other physiological parameters also. A best growing media should have proper aeration, water holding capacity and adequate nutrition supply when applied in combination with soil less substrates [8]. Different vegetative and reproductive growth parameters produced best results favored by different soil less media as observed in many crops viz., rose [9], *Lagerstroemia speciose* [10], Dieffenbachia plant [11] and tuberoose [12,13] Lalitha Kameswari et al., 2014 also observed the effect of potting media in chrysanthemum cultivation and found maximum plant height, plant spread, number of branches per plant, duration of flowering, flower weight, spray length and number of flowers per plant in the media containing Cocopeat + Sand + FYM + Vermicompost. Hence, the present research was undertaken to investigate the effects of different potting media contributing to good plant growth, and yield of chrysanthemum under agro ecological conditions of Bangladesh.

2. MATERIALS AND METHODS

Experimental Site: The present investigation was carried out at the experimental farm of Landscape, Ornamental and Floriculture Division, HRC, BARI, Gazipur during the period from July 2007 to June 2008.

Treatments: There were seven treatments in the experiment, comprising varying proportion of different potting media in Table 1. The treatment combinations used in the experiment were:

Pot preparation: The experiment was conducted in earthen pots of 12 cm size. The pots were washed and cleaned thoroughly before filling the potting media.

Design and layout of the experiment: The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications under

natural condition. One plant was planted in a pot, containing the potting media according to the treatments and five plants were constituted the unit of treatment.

Seedling raising, transplanting and fertilization: Primarily cuttings of CM-022 were prepared for planting in the sand in mid-August, 2007. Immediately after rooting, the mini plantlets were transferred to pot. The basic substrates were rice husk, cocodust and soil which were used singly and in combinations. All the mixtures were made on a v/v basis. The potting media were made available two months before transplanting of Cuttings and kept in shady place by covering with polyethylene sheet. Watering was done to decompose media twice in a week for two months. Before 30 days of transplanting each pot was supplied with well rotten oil cake at 150 g/pot. The oil cake was well mixed into the surface soil of the pots with the help of khurpi. Urea at 5 and 7 g per pot was applied at 25 and 35 days after transplanting. P₂O₅ and K₂O at 5 g per pot were applied for getting best growth and flowering of plants according to [14].

Irrigation and weeding: Weeding and mulching were done in the pots whenever it was necessary to keep the pots free from weeds. Chrysanthemum plants need frequent irrigation. The pots were irrigated at every alternate day to keep the media moist.

Staking of plant: Each plant was supported by 40 cm long bamboo stick to facilitate the branches of the plant to keep erect. The plant in each pot was fastened loosely with the bamboo stick by jute string to prevent the plant from lodging.

Pest and disease control: Ridomil 2g /L and Malathion 2ml/L of water was sprayed at fortnight interval as protective measures against diseases and insect attack.

Harvesting of flowers: The spikes were harvested when the flower attained commercial stage (Flower open before shedding of pollens from the outer row of the disc florets).

Collection of data: Data were collected on the following parameters for interpretation of the result of the experiment.

Plant height: Plant height refers to the length of the plant from ground level to tip of erect leaf. Height of 5 plants was measured and the mean was calculated. It was expressed in cm.

Number of leaves plant⁻¹: Number of leaves per plant was recorded by counting all the leaves from 5 plants and the mean was calculated.

Table 1. Treatments and composition of different media

Treatments	Composition
T ₁	100% soil
T ₂	50% soil + 25% cowdung + 25% cocodust
T ₃	100% cocodust
T ₄	50% soil + 25% cowdung + 25% rice husk
T ₅	50% cocodust + 25% cowdung + 25% soil
T ₆	50% cocodust + 25% rice husk + 25% cowdung
T ₇	100% rice husk

Plant spread: The plant spread was measured in cross way (North-South and East-West) by measuring scale. The average of the two measurements was done and expressed in cm.

Number of sucker's plant⁻¹: Number of sucker's plant⁻¹ was recorded by counting suckers from 5 individual plant and then mean was calculated.

Leaf size: The length and breadth of leaf was measured by a measuring scale and the average of the two measurements was done and expressed in cm for a single leaf. Later on, the mean of individual leaf size from 5 selected plants was calculated.

Number of branches plant⁻¹: Number of branches per plant was recorded by counting all the main branches from 5 plants and the mean was calculated.

Days to flowering: It was recorded by counting the days from planting to first visibility of flower bud in the plant from each pot.

Stalk length: Length of the stalk was measured from base to the tip of the spike and was expressed in cm.

Number of flowers plant⁻¹: Number of flowers produced per plant was counted and recorded.

Flower size: Flower size was measured in cross way following North-South and East-West position by a measuring scale and the average of the two measurements was done and expressed in cm for a single flower. Later on, the mean of individual flower size from 5 selected plants was calculated.

Weight of flower stalk: Weight of flower stalk were measured in grams from randomly 5 selected plants of each treatment and then average was calculated.

Flowering duration: Flowering period was recorded from the time of first flower opening to full bloom of last flower bud.

Statistical analysis: The data recorded on different plant and floral parameters were statistically analyzed through analysis of variance with the help of

'MSTAT' software. The difference between treatment means were compared by Duncan's Multiple Range Test (DMRT) [15].

3. RESULTS AND DISCUSSION

The effect of different potting media on morphological and floral characteristics of chrysanthemum was investigated in this study. The findings of the present study presented have been discussed in following heading.

3.1 Plant Height

Significant variation was observed among the treatments for plant height (Table 2). It varied from 54.0 to 66.0 cm. The treatment T₃ had the tallest plant (66.0 cm) followed by T₄ (63.0 cm), T₂ (62.8 cm) and T₅ (61.7 cm). The height of plant was found to be minimum in T₇ (54.0 cm). The results are in more or less close conformity with findings of [14] who recorded the highest plant height of chrysanthemum of 65.0 cm.

3.2 Number of Leaves

The number of leaves produced in different treatments varied significantly presented in Table 2. The number of leaves per plant ranged from 208-240. The treatment T₃ was found to be superior and produced the highest number of leaves per plant (240) followed by T₅ (233) and T₂ (231). Adequate numbers of leaves are essential for normal growth and production. An increase in number of leaves causes the accumulation of greater photosynthates leading to better growth parameters. The treatment T₇ produced the lowest number of leaves (208).

3.3 Leaf Size

The difference in leaf size among the treatments was observed to be statistically significant (Table 2). The highest leaf size (8.5 cm) was recorded in treatment T₃ while the shortest was in T₇ (4.3cm). The shortest

Table 2. Effect of potting media on some morphological characteristics of chrysanthemum at different growth stages

Potting media	Plant height (cm)	No. of leaves	Leaf size (cm)	Plant spread (cm)
T ₁	57.0 cd	225 bc	4.5 c	23 c
T ₂	62.8 ab	231 b	6.0 b	25 bc
T ₃	66.0 a	240 a	8.5 a	32a
T ₄	63.0ab	220 c	5.2 bc	22 cd
T ₅	61.7 b	233 ab	7.8 ab	28 b
T ₆	58.0 c	220 c	5.0 bc	26 bc
T ₇	54.0 d	208 d	4.3 c	19 d
CV (%)	14.5	16.0	5.4	11.7

Means in a column having common letter (s) are not significantly different from each other at 5% level of significance by DMRT

Note: T₁ = 100% soil, T₂ = 50% soil + 25% cowdung + 25% cocodust, T₃ = 100% cocodust, T₄ = 50% soil + 25% cowdung + 25% rice husk, T₅ = 50% cocodust + 25% cowdung + 25% soil, T₆ = 50% cocodust + 25% rice husk + 25% cowdung, T₇ = 100% rice husk

leaf size producing treatment was statistically identical with those of treatment T₁ (4.5 cm). The leaf size of chrysanthemum produced by the 'Toms' variety was reported to be 9 cm in cocopeat substrate [16] which is similar as has been found in the genotype CM-018 in treatment T₃.

3.4 Plant Spread

There was wide variation among the treatments for plant spread (Table 2). It varied from 19.0 cm to 32.0 cm. The highest plant spread was obtained from the treatment T₃ (32.0 cm) followed by treatment T₅ (28.0 cm). Treatments T₂ and T₆ produced in the range of 25.0 cm - 26.0 cm and they were statistically identical to each other. The lowest was in T₇ (19.0 cm).

3.5 Number of Branches

The number of branches was quite variable in different treatments (Fig. 1). The highest number of branch (12) was observed in T₃ treatment followed by T₅ treatment (10). The lowest number of branches was recorded in T₇ treatment (04). The above findings are in agreement with that of [17] in gerbera.

3.6 Days to Flower

Statistical difference regarding days to flowering were observed among the various treatments (Table 3). It varied from 55 to 70 days. The maximum days in T₇ (70 days) followed by T₆ (67 days) whereas the minimum by T₃ (55 days) closely followed by T₅ (58 days). [18] Tomati *et al.* 1993 reported that 'Dora' variety of chrysanthemum was found to take 50 days for 1st flowering in perlite medium.

3.7 Number of Flowers/Plants

Significant variation was observed regarding number of flowers produced per plant. It varied from 25-40

(Fig. 2). The highest number of flowers per plant was produced by T₃ (40) followed by T₅ (35). Plants of the treatments T₁ and T₇ produced the lowest number of flowers (25 and 27). Maximum number of flowers was also obtained in cocodust and cocodust with compost in gerbera reported by [18] Tomati *et al.* 1993.

3.8 Stalk Length

The difference in stalk length among the treatments was statistically significant (Table 3). The longest stalk was in treatment T₃ (13.3 cm) followed by T₅ (12.1 cm), T₂ and T₆ (11.0 cm) and T₄ (10.4cm). The shortest stalk length was observed in T₇ (8.8 cm). The results are in partial agreement with [19] who reported that the length of flower stalk in chrysanthemum ranged from 12.0 cm to 20.0 cm depending on various substrates used in 'Glory' variety of chrysanthemum.

3.9 Flower Size

The flower size of flowers was not significantly improved by various treatment of potting media. Similar results also observed in chrysanthemum during 1983 [20].

3.10 Average Weight of Flower Stalk

Potting media under the study had shown their differential responses with regard to average weight of flower stalk per plant (Table 3). The treatment T₃ produced the highest weight of flower stalk per plant (5.5 g) closely followed by T₅ (5.4 g). Contrasting to this, T₇ yielded the lowest (3.0 g) weight of flower stalk per plant. Similar results were reported by [16] Dutta *et al.* 2002 in chrysanthemum.

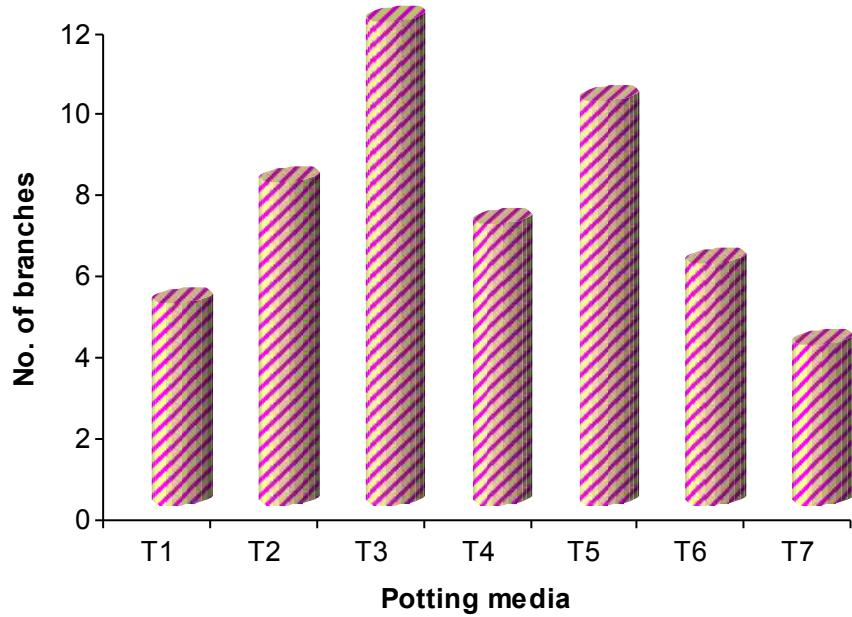


Fig. 1. Number of chrysanthemum branches as influenced by different potting media

Note: $T_1 = 100\% \text{ soil}$, $T_2 = 50\% \text{ soil} + 25\% \text{ cowdung} + 25\% \text{ cocodust}$, $T_3 = 100\% \text{ cocodust}$, $T_4 = 50\% \text{ soil} + 25\% \text{ cowdung} + 25\% \text{ rice husk}$, $T_5 = 50\% \text{ cocodust} + 25\% \text{ cowdung} + 25\% \text{ soil}$, $T_6 = 50\% \text{ cocodust} + 25\% \text{ rice husk} + 25\% \text{ cowdung}$, $T_7 = 100\% \text{ rice husk}$

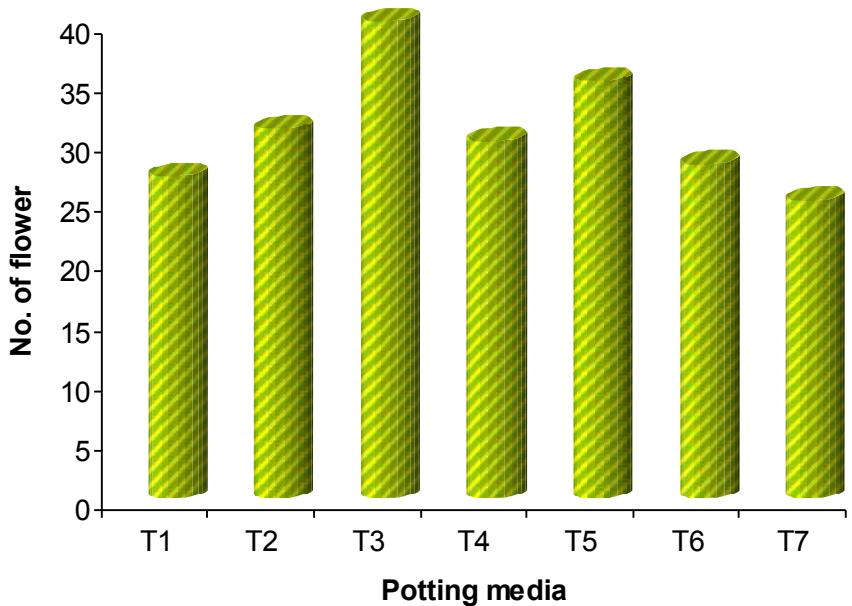


Fig. 2. Number of chrysanthemum flower as influenced by different potting media

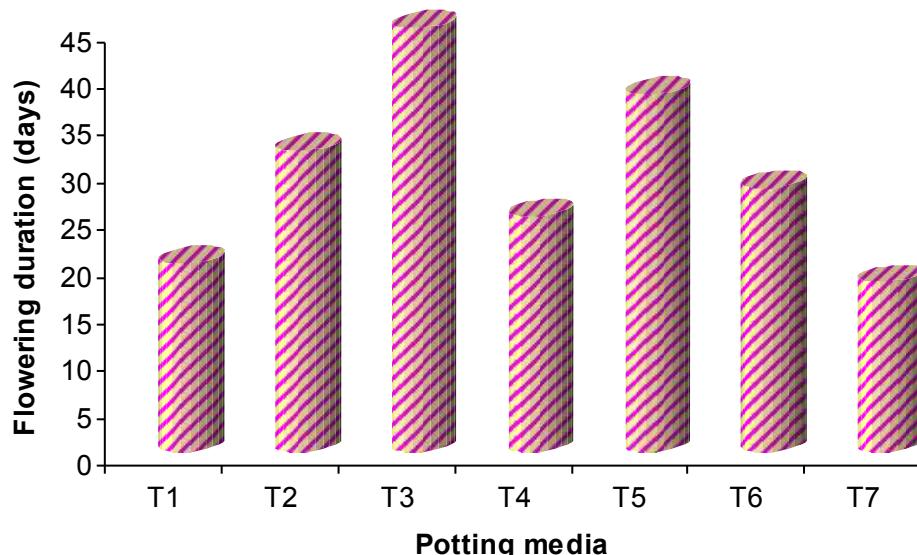
Note: $T_1 = 100\% \text{ soil}$, $T_2 = 50\% \text{ soil} + 25\% \text{ cowdung} + 25\% \text{ cocodust}$, $T_3 = 100\% \text{ cocodust}$, $T_4 = 50\% \text{ soil} + 25\% \text{ cowdung} + 25\% \text{ rice husk}$, $T_5 = 50\% \text{ cocodust} + 25\% \text{ cowdung} + 25\% \text{ soil}$, $T_6 = 50\% \text{ cocodust} + 25\% \text{ rice husk} + 25\% \text{ cowdung}$, $T_7 = 100\% \text{ rice husk}$

Table 3. Effect of different potting media on flower characteristics of chrysanthemum

Potting media	Days to Flower	Stalk length (cm)	Flower size (cm)	Av. wt. of flower stalk (g)
T ₁	65 b	10.0 bc	7.0	3.5 bc
T ₂	64 b	11.0 b	7.3	4.3 ab
T ₃	55 d	13.3 a	7.5	5.5 a
T ₄	60 c	10.4 bc	7.3	4.0 b
T ₅	58 cd	12.1 ab	7.4	5.4 a
T ₆	67 ab	11.0 b	7.2	4.2 ab
T ₇	70 a	8.8 c	6.9	3.0 c
CV (%)	11.5	10.2	12.4	9.7

Means in a column having common letter (s) are not significantly different from each other at 5% level of significance by DMRT

Note: T₁ = 100% soil, T₂ = 50% soil + 25% cowdung + 25% cocodust, T₃ = 100% cocodust, T₄ = 50% soil + 25% cowdung + 25% rice husk, T₅ = 50% cocodust + 25% cowdung + 25% soil, T₆ = 50% cocodust + 25% rice husk + 25% cowdung, T₇ = 100% rice husk

**Fig. 3. Flowering duration of chrysanthemum as influenced by different potting media**

Note: T₁ = 100% soil, T₂ = 50% soil + 25% cowdung + 25% cocodust, T₃ = 100% cocodust, T₄ = 50% soil + 25% cowdung + 25% rice husk, T₅ = 50% cocodust + 25% cowdung + 25% soil, T₆ = 50% cocodust + 25% rice husk + 25% cowdung, T₇ = 100% rice husk

3.11 Flowering Duration

Maximum duration of flowering was observed in cocodust (T₃) (45 days) followed by cocodust with soil and cowdung (T₅) (38 days) showed in Fig. 3. [18] Tomati *et al.* 1993 obtained similar results in chrysanthemum, where higher duration from full bloom to flower deterioration was observed in plants grown in cocodust substrate. The increased flowering duration could be attributed to conducive conditions in the media and higher nutrient uptake and utilization in plants grown in T₃ and T₅ media. The minimum flowering duration was in T₇ and T₁ (18 and 20 days).

4. CONCLUSION

Considering the current finding of this research works, it could be concluded that the treatment T₃ (100% cocodust) showed the highest growth and yield attributes in chrysanthemum production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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